

Amendments to the Claims

The following Listing of Claims replaces all prior versions, and listings, of claims in the application.

Listing of Claims:

1. (currently amended) A method ~~for analyzing~~ of processing an image of elements, the method comprising the steps of:
receiving data representing a plurality of elements of an image;
characterizing each element in the plurality assigning each of multiple ones of the elements a respective element label selected from a set of at least three element labels that includes according to a perceived characteristic including a characteristic corresponding to an at least one edge element label;
grouping spatially connected ones of the elements into respective blobs based on the element labels assigned to the elements, wherein each of the blobs is assigned a respective one of at least two blob labels; and
processing ones of the elements based at least in part on the blob labels assigned to the blobs the and the element labels assigned to the elements identifying each element having a given characteristic that is adjacent an element having a characteristic approximately the same as the given characteristic.

2. (currently amended) The method of claim 1, further comprising segmenting spatially connected ones of the elements in each of the blobs into respective sub-blobs based on the labels assigned to the elements, wherein each of the sub-blobs is assigned to a respective one of at least two sub-blob labels, wherein the processing is based at least in part on the sub-blob labels assigned to the sub-blobs wherein the step of receiving data includes the step of receiving data from a memory location.

3. (currently amended) The method of claim 1, wherein the ~~step of characterizing~~ includes the step of characterizing a plurality of elements correspond to pixels representing an of the image.

4. (currently amended) The method of claim ~~31~~, wherein the ~~step of characterizing~~ includes the step of identifying pixels representing background assigning comprises determining a white threshold value from luminance values associated with ones of the elements.

5. (currently amended) The method of claim ~~34~~, wherein the ~~step of characterizing~~ includes the step of identifying pixels representing black information assigning comprises determining a black threshold value from the determined white threshold value.

6. (currently amended) The method of claim ~~31~~, wherein the assigning comprises determining a color threshold based at least in part on color values respectively associated with ones of the elements ~~step of characterizing includes the step of identifying pixels representing~~ color information.

7. (canceled)

8. (currently amended) The method of claim 1, wherein the ~~step of characterizing~~ includes the step of evaluating a luminance value for a pixel and comparing the luminance value to a number assigning comprises labeling ones of the elements with respective ones of the element labels based at least in part on luminance values respectively associated with the elements.

9. (currently amended) The method of claim 8, wherein the labeling comprises comparing the luminance values to ~~step of evaluating a luminance value includes the step of comparing the~~ luminance value to a number representing a white threshold value.

10. (currently amended) The method of claim 8, wherein the labeling comprises comparing the luminance values to~~step of evaluating a luminance value includes the step of~~
comparing the luminance value to a number representing a black threshold value.

11. (currently amended) The method of claim 8, wherein the labeling comprises~~step of~~
evaluating a luminance value includes the step of assigning to each of multiple ones of the pixel
elements a representation of either one of a respective one of a black element label, a white
element label, or and a gray element label based on comparisons of the luminance values to a
white threshold and a black threshold.

12. (currently amended) The method of claim ~~8~~1, wherein the ~~step of evaluating a~~
~~luminance value includes the step of~~labeling comprises assigning to each of multiple ones of the
pixel elements a representation of either one of a respective one of a black element label, a white
element label, and or a color element label.

13. (currently amended) The method of claim 1, wherein the grouping comprises
grouping spatially connected ones of the elements that are assigned element labels within a first
subset of the element labels into a respective one of the blobs assigned a first blob label, and
grouping spatially connected ones of the elements that are assigned element labels within a
second subset of the element labels into a respective one of the blobs assigned a second blob
label ~~step of identifying each element that is adjacent includes the step of identifying each~~
~~element that is adjacent an element having the given characteristic.~~

14. (currently amended) The method of claim 1, wherein the ~~step of identifying each~~
~~element that is adjacent includes the step of using~~grouping is based on a respective an eight-
neighbors system connectivity analysis performed for each of the elements.

15. (currently amended) The method of claim 1, wherein the grouping comprises ~~step of~~
~~identifying each element that is adjacent includes the step of identifying~~ labeling at least some of
adjacent pixels ones of the elements with a ~~that are background pixels~~ blob label.

16. (currently amended) The method of claim 15, wherein the grouping comprises ~~step of identifying each element that is adjacent includes the step of identifying~~ labeling adjacent ones of the elements that are outside the background blob label pixels that are with a non-background blob label pixels.

17. (currently amended) The method of claim 12, wherein the segmenting comprises ~~step of identifying each element that is adjacent includes the step of identifying~~ segmenting adjacent ones of the elements pixels that are characterized as either into a respective one of a black sub-blob label, a gray sub-blob label, a gray edge sub-blob label, a color sub-blob label, a color edge sub-blob label, or and a white sub-blob label.

18. (currently amended) The method of claim 12, wherein the grouping comprises ~~step of identifying each element that is adjacent includes the step of identifying~~ assigning at least some adjacent ones of the elements pixels that are characterized as a background blob label, and further including the step of the segmenting comprises segmenting at least some identifying adjacent ones of the elements assigned the background blob label into a respective one of the sub-blob labels based on the element labels assigned to the elements pixels characterized as background and also characterized with a label.

19. (currently amended) The method of claim 12, wherein the grouping comprises ~~step of identifying each element that is adjacent includes the step of identifying~~ labeling at least some adjacent ones of the elements with pixels that are characterized as a non-background blob label, and further including the step of the segmenting comprises assigning a respective one of the sub-blob labels to at least some identifying adjacent ones of the elements labeled with the non-background label based on the element labels assigned to the elements pixels characterized as non-background and also characterized with a label.

20. (currently amended) The method of claim 19, wherein the ~~step of identifying pixels with a label include the step of~~ segmenting comprises labeling adjacent ones of the elements

assigned the non-background blob label with identifying pixels a respective labeled one of an edge element sub-blob label, a color element sub-blob label, a gray element sub-blob label, and a black element sub-blob label.

21. (currently amended) The method of claim 19, further comprising classifying each of multiple ones of the blobs into a respective one of at least two blob type classes based on the blob label assigned to the blob and statistics of the sub-blobs linked to the blob~~the step of determining if the number of non-background pixels having a given label and that are adjacent are less than or greater than a given number.~~

22. (canceled)

23. (currently amended) The method of claim 22-1, wherein the ~~step of identifying elements of the image representing an edge includes the step of using a gradient operation on groups of pixels to determine if an individual pixel is part of an edge~~assigning comprises applying a gradient operator to ones of the elements to produce gradient data and labeling ones of the elements with the edge element label based on the gradient data.

24. (currently amended) The method of claim 22-2, wherein the ~~step of identifying elements of the image that represent an edge and that are adjacent includes the step of selecting a first pixel that represents an edge, and identifying a plurality of adjacent pixels, and identifying any of the plurality of adjacent pixels that represent an edge~~segmenting comprises labeling at least some adjacent ones of the elements with an edge sub-blob label.

25. (currently amended) The method of claim 24, wherein the ~~step of identifying a plurality of adjacent pixels includes the step of identifying pixels that are the next pixel away from the first pixel~~segmenting comprises labeling at least some neighboring ones of the elements with the edge sub-blob label.

26. (currently amended) The method of claim 24, wherein the ~~step of identifying a plurality of adjacent pixels includes the step of identifying pixels according to the~~labeling is based on an eight-neighbors system connectivity analysis performed for each of the elements.

27. (currently amended) The method of claim 24, wherein the ~~step of identifying any of the plurality of adjacent pixels that represent an edge includes the step of~~labeling comprises labeling the at least some adjacent pixels~~ones of the elements with a respective label selected from that represent an~~a white edge sub-blob label with and a unique~~gray edge sub-blob label.~~

28. (currently amended) The method of claim 24, wherein the ~~step of identifying any of the plurality of adjacent pixels that represent an edge includes the step of~~segmenting comprises identifying pixels~~elements that are assigned the edge element label representing an edge that and are adjacent at least two other pixels representing an edge~~elements each of which is assigned the edge element label.

29. (currently amended) The method of claim 24, ~~further comprising the step of~~wherein the segmenting comprises labeling ones of the elements having similar~~element labels with respective ones of the sub-blob labels~~identifying pixels representing substantially the same image characteristic.

30. (currently amended) The method of claim 29, wherein the ~~step of identifying pixels representing substantially the same image characteristic includes the step of~~labeling comprises identifying pixels~~ones of the elements assigned an identical element label selected from having a label corresponding to the same characteristic of one of~~a color element label, a gray element label, or and a black element label.

31. (currently amended) The method of the claim 30, wherein the labeling comprises further comprising the step of identifying pixels having the same labels~~spatially connected ones of the elements that are assigned a mutual one of the selected element labels and that are connected to one another.~~

32. (currently amended) The method of claim 31, wherein the ~~step of identifying of~~
~~spatially connected ones of the elements comprises pixels that are connected~~ includes the step of
identifying ~~pixels~~ones of the elements that are assigned the mutual element label having the same
~~label that~~and are connected through other pixels~~ones of the elements assigned the mutual~~
~~element label having the same label.~~

33. (currently amended) The method of claim 32, wherein the ~~step of identifying pixels~~
~~having the same label that are connected~~ includes the step of grouping comprises labeling
connected ones of the identified elements assigned the mutual element label with a non-
background sub-blob label~~applying a sub-label to the connected pixels that have the same label.~~

34. (currently amended) The method of claim 29, wherein the segmenting comprises
~~further comprising the step of identifying connected ones of the elements pixels having at least~~
one element label in common~~substantially the same image characteristic and that are~~
~~interconnected.~~

35. (currently amended) The method of claim 34, ~~further comprising the step of wherein~~
the segmenting comprises assigning a respective one of the sub-blob labels~~applying a unique~~
sub-label to each set of the inter-connected pixels~~elements having the at least one element label~~
in common~~same image characteristic.~~

36. (currently amended) The method of claim 34, further comprising ~~the step of~~
determining for each of multiple ones of the blobs a respective~~the number of constituent ones of~~
the interconnected pixels~~elements having substantially the same image characteristic~~a first one
of the element labels in common.

37. (currently amended) The method of claim 36, ~~wherein the image characteristic is a~~
~~first image characteristic, and~~ further comprising for each of multiple ones of the blobs the step
of determining the a respective second number of constituent ones of the interconnected

pixelselements that have ~~a second image characteristic~~ one of the element labels in common, and comparing it to the respective first and second numbers of pixelselements having the first image characteristic.

38. (currently amended) The method of claim 37, further comprising ~~the step of~~ identifying pixelselements that have ~~having the first image characteristic~~ element label in common and ~~that~~ are adjacent to pixelselements having the second image characteristic ~~element label in common~~.

39. (currently amended) The method of claim 37, ~~further comprising the step of~~ wherein the processing comprises changing attribute values of the pixelselements having the second image characteristic ~~element label in common to an image characteristic~~ values that are closer to corresponding attribute values of the elements having the first image characteristic ~~element label in common~~.

40. (currently amended) The method of claim 39, wherein the ~~step of changing includes the step of~~ comprises changing a numerithe attribute values for of the pixelselements having the second image characteristic ~~element label in common~~ by multiplying their numeric attribute values by a number less than one.

41. (currently amended) The method of claim 39, wherein the ~~step of changing includes the step of~~ comprises changing a numerithe attribute values for of the pixelselements having the second image characteristic ~~element label in common~~ to an average of a numerithe corresponding attribute values of for the pixelselements having the first image characteristic ~~element label in common~~.

42. (currently amended) The method of claim 37, wherein the first ~~image characteristic~~ is element label is a black element label and the second ~~image characteristic~~ is element label is different from the other than black element label.

43. (currently amended) The method of claim 42, further comprising for each of the blobs the step of counting the comparing number of connected elements labeled with the second element label non-black pixels that are interconnected and comparing to the number of interconnected elements labeled with the black pixel element label.

44. (currently amended) A-The method of claim 2 processing elements in an image, the method comprising the steps of wherein:

receiving a plurality of elements in an image;

characterizing each element in the plurality of elements according to a perceived characteristic;

the grouping comprises labeling ones of the elements with a background blob label identifying each element having a characteristic representing background that is adjacent an element having a characteristic also representing background;

the assigning comprises assigning ones of the identifying elements of the plurality of elements of the image that represent an edge element label of a portion of the image; and

the segmenting comprises identifying segmenting connected ones of the elements of assigned the image that represent an edge element label to an edge sub-blob label and that are adjacent at least one other element representing an edge.

45. (currently amended) The method of claim 44, further including wherein the assigning comprises labeling ones of the identifying elements of the plurality of elements of the image that represent with a black element label.

46. (currently amended) The method of claim 44, further including identifying wherein the assigning comprises labeling each of multiple ones of the elements with a respective of the plurality of elements of the image that represent one of a gray element label and a gray edge element label.

47. (currently amended) The method of claim 44, wherein identifying elements of the plurality of elements of the image that represent an the labeling of ones of the elements with the

~~edge element label comprises assigning each of multiple ones of the of a portion of the image~~
~~include identifying elements to a respective that represent one of a white edge element label, a~~
~~gray edge element label, and a color edge element label.~~

48. (currently amended) The method of claim 44, ~~further including wherein the~~
~~segmenting comprises assigning a respective sub-blob label and a respective blob pointer to each~~
~~of multiple ones of the elements and further including assigning pointers, and wherein such that~~
~~identical blob pointers are assigned to connected ones of the elements assigned an identical sub-~~
~~blob label a first pointer assigned to an element having a first label is also assigned to an adjacent~~
~~element having the first label.~~

49. (currently amended) The method of claim 44, wherein ~~identifying elements of the~~
~~image that represent an edge includes the assigning comprises applying a gradient operator to~~
~~ones of the elements to produce gradient data and labeling ones of the identifying elements of an~~
~~image representing an with the edge element label based on using a the gradient data operation.~~

50. (currently amended) A- ~~The method of claim 2 for analyzing an image, wherein ones~~
~~of the elements are associated with respective grayscale image data method comprising:~~

~~receiving data representing a plurality of elements of an image wherein the data includes~~
~~grayscale image data;~~

~~characterizing, as a function of the grayscale image data, elements in the plurality of~~
~~elements according to a perceived characteristic wherein a perceived characteristic includes an~~
~~edge characteristic; and~~

~~identifying each element having a given characteristic that is adjacent an element having~~
~~a characteristic approximately the same as the given characteristic.~~

51. (currently amended) The method of claim 50, ~~further including identifying, as a~~
~~function of wherein the assigning comprises assigning ones of the elements a black element label~~
~~based on the grayscale image data, elements of the plurality of elements of the image that~~
~~represent black.~~

52. (currently amended) The method of claim 50, wherein the assigning comprises assigning ones of the elements a respective~~further including identifying elements of the plurality of elements of the image that represent one of a gray element label and a gray edge element label.~~

53. (currently amended) The method of claim 50, wherein the assigning of ones of the elements the edge element label comprises labeling each of multiple ones of the elements with a respective identifying elements of the plurality of elements of the image that represent an edge of a portion of the image include identifying elements that represent one of a white edge element label, a gray edge element label, and a color edge element label.

54. (currently amended) The method of claim 50, further comprising assigning a respective sub-blob label and a respective blob pointer to each of multiple ones of the elements such that identical pointers are assigned to connected ones of the elements assigned an identical sub-blob label~~including assigning a label to each element and further including assigning pointers, and wherein a first pointer assigned to an element having a first label is also assigned to an adjacent element having the first label.~~

55. (currently amended) The method of claim 50 wherein the assigning comprises applying a gradient operator to ones of the elements to produce gradient data and labeling ones of the elements with the edge element label based on the gradient data~~identifying elements of the image that represent an edge includes identifying elements of an image representing an edge using a gradient operation.~~

56. (currently amended) The method of claim 50, ~~further including~~ wherein the segmenting comprises identifying adjacent image ones of the elements that represent assigned the an edge element label, and labeling the identified adjacent image elements that represent an edge with a unique~~unique~~ respective ones of the sub-blob labels.

57. (currently amended) The method of claim 50, further comprising for each of multiple ones of the blobs:

determining a respective number of connected ones of the constituent elements assigned a first one of the element labels;

determining a respective second number of connected ones of the constituent elements assigned a second one of the element labels; and

classifying ones of the blobs based on comparisons of the respective first and second numbers of elements ~~wherein the perceived characteristic is a first image characteristic, and further including determining the number of interconnected image elements that have a second image characteristic and comparing it to the number of image elements having the first image characteristic.~~